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Complete Specification for the invention entitled:

"IMPROVEMENTS IN OR RELATING TO CLADDING"

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

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(12) PATENT ABSTRACT
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(54) CLADDING

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(57) Claim

1. A cladding sheet for a building framework, including: a generally planar body portion having opposed faces; and, a pair of edge portions extending along the body portion, at least one of the edge portions extending generally perpendicularly outwardly of both of the faces of the body portion, construction and arrangement of the cladding sheet being such that a plurality of sheets can be positioned in side by side juxtaposed relationship, the juxtaposed edge portions of adjacent sheets together defining a bearing beam running between the body portions of those sheets to provide rigidity to the cladding sheets when fixed to the building framework.

This invention relates generally to cladding and particularly cladding sheets, cladding units incorporating those sheets, and their fixing to a building framework. The cladding sheets and units are particularly useful as outer roof and wall covering for buildings and it will be convenient to hereinafter describe this invention in relation to this example application. It is to be appreciated, however, that the invention is not restricted to that example application.

It is well known to provide cladding sheets of generally elongated rectangular form to constitute covering of the roof and walls of a building. The sheets are not usually flat but rather are formed with such a cross-sectional profile that the assembled cladding represents a generally flat appearance with a number of small upstanding parallel and substantially equally spaced small ribs or other similar interruptions. Sometimes, each of the sheets has a female interlocking zone along one longitudinal edge and a male interlocking zone along the other longitudinal edge, adjacent sheets joined by interengagement of the male zone of one sheet in the female zone of the other sheet to form a small rib.

To prevent relative movement of the male and female zones, and to secure the cladding sheets to a building framework, fixing straps are provided. Those fixing straps are generally secured to the cladding support structure of the building framework, for example, the purlins in the case of roof cladding, and the cladding sheets placed over the fixing straps at least one end thereof engaging within a rib. Usually a plurality of narrow fixing straps are spaced equidistant along the ribs of each cladding sheet to secure it to the supporting structure.

With these prior arrangements it has been found, however, that the cladding sheets are not very rigid even with the upstanding ribs acting as strengthening ribs, and so are prone to distortion under any substantial bearing loads. In an effort to minimize that distortion posibility the members of the cladding supporting structure are arranged at closely spaced apart intervals. However, with the ever increasing costs of such members, and their installation, such a procedure is rapidly becoming economically unattractive.

It is an object of the present invention to alleviate the foregoing disadvantages through the provision of a simple cladding sheet and cladding unit incorporating that sheet which is relatively stronger and so minimizes its support structure requirements.

According to one aspect of the present invention there is provided a cladding sheet for a building framework, including: a generally planar body portion having opposed faces; and, a pair of edge portions extending along the body portion, at least one of the edge portions extending generally perpendicularly outwardly of both of the faces of the body portion, construction and arrangement of the cladding sheet being such that a plurality of sheets can be positioned in side by side juxtaposed relationship, the juxtaposed edge portions of adjacent sheets together defining a bearing beam running between the body portions of those sheets to provide rigidity to the cladding sheets when fixed to the building framework.

The above cladding sheet provides very rigid cladding for building frameworks and, as such, reduced support structure members are required to constitute those frameworks in order to firmly support that cladding. Any additional cladding sheet material required for this invention is more than offset by the reduction in the framework support structure members thereby minimizing both construction material and time and thus ultimately, cost.

The description of this invention is made with reference to the cladding sheet in a horizontal orientation with the external face thereof uppermost, and terms such as "upstanding", and "downward" should be construed in the light of this orientation. It is to be appreciated, however, that other orientations are equally possible and that consequential changes may be necessary to the terms such as above in the light of those other orientations.

Preferably, the cladding sheet is of an elongated rectangular form, having opposed external and internal faces, the edge portions extending longitudinally of the body portion, with the cladding sheet having a pair of parallel, transversely extending end portions.

The body portion is preferably locally ribbed or otherwise interrupted longitudinally to provide rigidity to that body portion. Those ribs or interruptions preferably upstand from the external face of the body portion, but may be of any suitable shape, for example, abrupt inverted U or V shape or smooth wave shape.

Preferably, both edge portions extend generally perpendicularly from the plane of the body portion. In that regard, preferably, those edge portions extend generally downwardly from the internal face thereof. This construction is such that the juxtaposed edge portions of adjacent cladding sheets be in or near abutment to form continuous cladding, the edge portions, in use bearing on support structure members of the framework being clad.

Each edge portion preferably includes a connection zone which interconnects that edge portion to the body portion, that connection zone is preferably so shaped as to give a visual impression of profile continuity between adjacent sheets. In that regard, the connection zone is shaped as to allow abutment with the connection zone of a juxtaposed edge portion.

Where the body portion is a planar profile then the connection zones may simply be a planar shape extension of that body portion. Alternatively, where the body portion is longitudinally ribbed or of an otherwise similarly interrupted profile then the connection zones may be shaped so that juxtaposed edge portions continue that profile.

Each edge portion preferably also includes a web zone which extends downwardly from each of the connection zones, perpendicular to the general plane of the body portion. Preferably, those web zones are substantially planar so as to allow their abutment with the web zone of a juxtaposed edge portion.

Interconnection means may be provided on those web zones to allow interconnection between juxtaposed edge portions. That interconnection means may include at least one abutment shoulder on each of the web zones, abutment shoulders of juxtaposed edge portions lying in opposed abutment thereby resisting relative upward or downward movement between those edge portions.

The abutment shoulders may be defined by at least one abutment rib extending longitudinally along one web zone and at least one abutment groove extending longitudinally along the other web zone the construction being such that the abutment rib(s) on an edge portion of a cladding sheet may extend into and engage the abutment groove(s) on an edge portion of an adjacent sheet. The abutment rib(s) and groove(s) may be of any complementary shape, such as saw tooth shape, one abutment shoulder being provided on each web zone with the abutment rib shoulder facing upward and the abutment groove shoulder facing downward.

Each edge portion preferably further includes a bearing zone extending from each of the web zones, those bearing zones being so constructed and arranged that, in use, those bearing zones directly or indirectly bear on support structure members of the framework being clad thereby to support the cladding sheets thereon. To that end, each bearing zone preferably defines a bearing face adapted to directly or indirectly bear on those support structure members. Those bearing zones preferably extend laterally of their respective web zones, as well as longitudinally thereof so as to provide broad bearing faces for stably mounting the cladding sheets.

The bearing zones may be arranged so that, in use, those bearing zones of juxtaposed edge portions be in side-by-side relation with their bearing faces co-planar, and both bear directly on the support structure members. In this arrangement, each bearing zone may extend laterally inward of the respective web zone toward the other bearing zone of the same cladding sheets. This then allows juxtaposed edge portions of adjacent cladding sheets to be butted together along their entire height.

Alternatively, the bearing zones may be arranged so that, in use, those bearing zones of juxtaposed edge portions interlock to firmly secure the adjacent cladding sheets together. In this arrangement a male bearing zone is preferably provided on one edge portion of the cladding sheet, whilst a female bearing zone is preferably provided on the other edge portion, insertion of a male bearing zone into a female bearing zone causing interlocking. This arrangement causes the bearing face of the male bearing zone to bear directly on the female

bearing zone and the bearing face of the female bearing zone to bear directly on the support structure members. In this arrangement at least the female bearing zone may extend laterally inward and outward of the respective web zone relative to the cladding sheet so as to provide central support for the interlocked edge portions.

The bearing zones may be of any suitable shape. In that regard, they may be generally channel or part rectangular in transverse cross-section, although local modifications may be provided as required to assist with interlocking of the bearing zones and securing of the cladding sheets to the support structure members. One side of such shaped bearing zones may define the bearing face.

The cladding sheet body portion and edge portions may be of unitary construction and may be composed of any suitable material and made by any suitable manufacturing process. As an example, the cladding sheet may be composed of sheet metal such as galvanized steel and bent formed such as by rolling.

According to another aspect of the present invention there is provided a cladding unit for a building framework including: the above cladding sheet; and cover means extending parallel to the body portion between the edge portions of the cladding sheet and defining an interior surface for the unit.

The cover means preferably includes one or more generally sheet-like cover members supported therein, spaced from the body portion so as to define a cavity therebetween. Preferably, those cover members are removably so supported to allow access into the cavity for placement and maintenance of building services componentry which may extend within that cavity.

The cover members are preferably rectangular with a pair of opposed longitudinally extending edge portions and preferably those cover members are supported within the cavity by the edge portions bearing on respective cladding sheet bearing zones. To that end those bearing zones are each preferably provided with a support face on which the cover members are supported.

The cover members may be a series of cover panels

extending along the cladding sheet. Those panels may be composed of any suitable material such as compressed straw or wood and the outer surface thereof may be decoratively finished as may be required.

The cladding unit may also include heat insulating material provided in the cladding sheet cavity, intermediate the cover panels and cladding sheet body portion to provide the cladding unit with heat insulating characteristics. Any suitable material may be so used, for example, fibreglass or rockwool.

Where the cladding unit is to be used in cladding widely spaced apart framework support structure members and the unit is of any substantial width, that unit may also include strengthening means to reinforce the cladding sheet against distortion, particularly longitudinal distortion. Preferably, that strengthening means includes a plurality of elongated strengthening members extending within the cavity in spaced apart relation across the cladding sheet. Preferably, those strengthening members extend between the cladding sheet web zones and are fastened to the cladding sheet completely within the cavity.

The strengthening members may be strengthening struts. Those struts may be composed of any suitable material such as wood or metal and may be fastened to the body portion and/or the edge portions of the cladding sheet with fastening elements such as nails, clips or bolts.

The cladding unit may also include sealing means adapted to weather seal between juxtaposed edge portions of adjacent cladding sheets. Preferably, that seal means is an elongated sealing strip adapted, in use, to overlie the connection zones of the juxtaposed edge portions. That sealing strip may be clippingly engageable with those connection zones to sealingly secure the sealing strip thereto. Alternatively, the sealing strip may be securely and sealingly fastened to one of the juxtaposed edge portions and adapted to extend therefrom over the other juxtaposed edge portion to clippingly engage and seal therewith. The sealing strip may be adapted to snap engage the edge portions. The sealing strip may be composed of sheet metal such as galvanized steel by a bending process

such as rolling.

A further aspect of the present invention provides in combination the above cladding sheet or cladding unit, a cladding fixing strap including: a base portion adapted to be secured to the building framework; and, a clipping portion adapted to engage one or both juxtaposed edge portions of adjacent cladding sheets thereby to fix those adjacent sheets to the building framework.

A plurality of such straps will be required to firmly secure the cladding sheet and unit, as will be more fully described hereinafter, but for convenience and simplicity the construction and operation of only one fixing strap is described in detail, it being appreciated that all other straps are similarly constructed and operated.

Preferably, the base portion is plate-like and is adapted to be secured to a support structure member either parallel or perpendicular to the general plane of the cladding sheet or unit which it is to secure to that support structure member. That base portion may be secured to the support structure member by, fastening elements such as nails or screws.

Preferably, the clipping portion upstands from the base portion and is adapted to engage in use either one or both of the connection zones or one or both of the bearing zones of the juxtaposed edge portions. Where the bearing zones interlock the clipping portion need engage only one of the edge portions. In engaging the connection zone(s) the clipping portion preferably includes an elongated spacer extending from the base portion and adapted to extend between the web zones of the juxtaposed edge portions to the connection zones thereof. The clipping portion preferably also includes at least one finger extending laterally from the spacer and formed to overlie one or a respective one of the connection zones. In this way one or both of the juxtaposed edge portions is captured between the finger(s) and support structure member to which the cladding sheet or unit is secured. The or each finger is preferably shaped to be compatible with the shape of the connection zone with which it is adapted to engage.

In engaging the bearing zone(s) the clipping portion preferably includes at least one finger upstanding from the

base portion and formed to liverlie at least a part of one or a respective one of the bearing zones. In this way one or both of the bearing zones is captured between the finger(s) and support structure member to which the cladding sheet or unit is secured.

The fixing strap may be composed of any suitable material and made by any suitable manufacturing process. As an example, that fixing strap may be composed of sheet metal such as galvanized steel and cut and bent formed therefrom.

The following description refers in more detail to the above features of the present invention. To facilitate an understanding of the invention, reference is made to the accompanying drawings where these features are illustrated in preferred embodiments, and it should be understood that the features of the invention are not limited to those embodiments as illsutrated in the drawings.

In the drawings where like reference numerals refer to like components:

Figure 1 is a top perspective view of a cladding sheet according to a preferred embodiment of the present invention;

Figure 2 is a bottom perspective view of cladding units, incorporating cladding sheets of Figure 1, and as fixed to a building framework according to a preferred embodiment of the present invention;

Figure 3 is a detailed elevational view of the fixing strap used to fix the adjacent cladding sheets to the framework as in Figure 2;

Figure 4 is a detailed elevational view of adjacent cladding sheets and a fixing strap according to another preferred embodiment of the present invention;

Figure 5 is a detailed elevational view of adjacent cladding sheets and a fixing strap according to yet another preferred embodiment of the present invention;

Figure 6 is a detailed elevational view of adjacent cladding sheets and a fixing strap according to a further preferred embodiment of the present invention; and

Figure 7 is a detailed elevational view of adjacent cladding sheets and a fixing strap according to a still further preferred embodiment of the present invention.

Referring initially to Figure 1, there is generally shown

unitary metal cladding sheet 1, including elongated body portion 2, having opposed external face 3, and internal face 4. Body portion 4, is generally planar but has a series of parallel, spaced apart reinforcement ribs 5, upstanding from external face 3, and extending longitudinally of body portion 2.

Cladding sheet 1, also includes edge portions 6,7, extending continuously along body portion 2. Edge portions 6,7, are so shaped as to allow those portions of adjacent cladding sheets 1, to abut against each other and together define a bearing beam.

Each edge portion 6,7, has connection zone 8, emerging from body portion 2, to generally upstand from external face 3, of body portion 2. Connection zones 8, are selectively profiled so that when edge portions 6,7, of adjacent cladding sheets 1, are placed in juxtaposition those connection zones 8, together define a further reinforcement rib and thereby maintain overall cladding continuity and profile between adjacent cladding sheets 1.

Each edge portion 6,7, also includes web zone 9, emerging from respective connection zones 8, and extending downwardly therefrom perpendicular to body portion 2. Abutment rib 10, is formed in web zone 9, of edge portion 6, and abutment groove 11, is formed in web zone 9, of edge portion 7. Abutment rib 10 and abutment groove 11, are profiled and positioned relative to each other so that abutment rib 10, of cladding sheet 1, can extend into and engages abutment groove 11, of an adjacent cladding sheet 1.

Edge portions 6,7, also include bearing zones 12, emerging from respective web zones 9, to terminate edge portions 6,7. Bearing zones 12, are generally U-shaped in transverse cross-section and may be arranged, as illustrated in Figure 1, so that bearing zone 12, of edge portion 6, of cladding sheet 1, can nestle within bearing zone 12, of edge portion 7, of an adjacent cladding sheet 1. Each bearing zone 12, defines opposed support faces 13, extending inwardly of web zones 9, so as to face but be spaced from body portion 2.

Body portion 2, and edge portions 6,7, of cladding sheet 1, together define cavity 14, within cladding sheet 1.

Referring now to Figure 2, there is generally shown

cladding, comprising a series of identical cladding units 15, fixed to building framework 16. One cladding unit 15, is shown in detail and includes cladding sheet 1, as illustrated in Figure 1, forming an exterior surface of unit 15.

Cladding unit 15, also includes a plurality of cover panels 17, connected to cladding sheet 1, and defining an interior surface of unit 15. Cover panels 17, extend in side by side relationship along unit 15, parallel but spaced apart from body portion 2, of cladding sheet 1, generally closing cavity 14. Edge portions 18, of each cover panel 17, bear on respective support faces 13, of edge portions 6,7, so that cover panels 17, are removably suspended therebetween.

Cladding unit 15, also includes a series of strengthening struts 19, spaced apart along cladding sheet 1, and extending across cavity 14, between edge portions 6,7. Strengthening struts 19, are fastened to cladding sheet 1, by means of clips 20, and nails 21.

Cladding unit 15, also includes heat insulating material 22, substantially filling cavity 14, thereof.

Elongated sealing strip 23, is provided in cladding unit 15, to weather seal between edge portions 6,7, of adjacent cladding sheets 1. Sealing strip 23, is profiled so as to overlie and clippingly engage connection zones 8, of edge portions 6,7.

Cladding units 15, are fixed to building framework 16, by means of a plurality of identical fixing straps 24, spaced apart along cladding units 15, and securing abutting edge portions 6,7, of adjacent cladding sheets 1, to building framework 16. One of those fixing straps 24, is illustrated in detail in Figure 3 and includes plate-like base portion 25, adapted to be secured to framework 16, by fastening elements such as nails or screws 26. Fixing strap 24, also includes clipping portion 27, integral with and upstanding from base portion 25, and adapted to engage bearing zones 12, of abutting edge portions 6,7, of adjacent cladding sheets 1. Clipping portion 27, has a pair of spaced apart fingers 28, between which bearing zones 12, are positioned and against which respective fingers 28, can be bent to engage. In this way, bearing zones 12, are captured between fingers 28.

Alternative edge portions 6,7, and fixing strap 24, arrangements are illustrated in Figures 4 to 6. Figure 4 illustrates fixing strap 24, having plate-like base portion 25, and integral clipping portion 27, extending upwardly therefrom between edge portions 6,7, with a pair of fingers 28, each extending over a respective connection zone 8, of edge portions 6,7. Fixing strap 24, illustrated in Figure 5, has plate-like base portion 25, and clipping portion 27, extending upwardly therefrom with one finger 28, extending about bearing zone 12, of edge portion 7, and other fingers 28, extending between and into bearing zones 12, of edge portions 6,7. Finally, Figure 6 illustrates fixing strap 24, having plate-like base portion 25, and clipping portion 27, upstanding therefrom between edge portions 6,7, with a single finger extending engagingly into bearing zone 12, of edge portion 7. Other edge portions 6,7, and fixing strap 24, arrangement may be equally possible.

In fixing cladding sheets 1, or cladding units 15, to framework 16, using fixing straps 24, initially, at one edge of framework 16, a first cladding sheet 1, or unit 15, is positioned with edge portion 6, adjacent the edge of framework 16. A series of fixing straps 24, are then each individually positioned until their fingers 28, clippingly engage connection zone 8, or bearing zone 12, of edge portion 6, and then base portion 25, of each fixing strap 24, is fastened to framework 16. Depending on the precise configuration of clipping portions 27, of fixing straps 24, and edge portion 6, of cladding sheet 1, or unit 15, that strap positioning may involve rotation of fixing straps 24, about edge portion 6, and/or local shaping of fingers 28, of fixing strap 24.

A series of fixing straps 24, are then secured to framework 16, along a line coincident to edge portion 7, of first cladding sheet 1, or unit 15. In so securing each of those straps 24, they are initially manoeuvred until fingers 28, clippingly engage connection zone 8, or bearing zone 12, of edge portion 7.

A second cladding sheet 1, or unit 15, is then positioned adjacent laid first cladding sheet 1, or unit 15, with edge portion 6, thereof juxtaposition edge portion 7, of first

[illegible] 1, or unit 15. In positioning that second [illegible] 1, or unit 15, it is manoeuvred until edge portion [illegible] interlocks with edge portion 7, of the first cladding [illegible] 1, and/or clippingly engages fingers 28, of fixing [illegible] 24. With adjacent cladding sheets 1, or units 15, so positioned a bearing beam for supporting sheets 1, or units 15, is defined by juxtaposed edge portions 6,7.

Successive fixing straps 24, and cladding sheets 1, or units 15, are similarly secured across framework 16, from second cladding sheet 1, or unit 15, to an opposite edge of framework 16. A final series of fixing straps 24, secured to framework 16, clippingly engage edge portion 7, of final cladding sheet 1, or unit 15.

Finally, sealing strips 23, are clipped over juxtaposed edge portions 6,7, of adjacent cladding sheets 1, or units 15, to seal between those sheets or units.

The cladding sheet and cladding unit of the present invention provides rigid cladding for building frameworks and, as such, reduced support structure members are required to constitute those frameworks in order to firmly support the cladding. Any additional cladding sheet material required for the cladding sheet and unit of the present invention is more than offset by the reduction in the framework support structure members thereby minimising both construction material and time and thus ultimately, cost.

Finally, it is to be understood that various modifications and/or alterations may be made to the cladding sheet, cladding unit, and fixing strap without departing from the ambit of the present invention as defined in the claims appended hereto.

The claims defining the invention are as follows:

1. A cladding sheet for a building framework, including: a generally planar body portion having opposed faces; and, a pair of edge portions extending along the body portion, at least one of the edge portions extending generally perpendicularly outwardly of both of the faces of the body portion, construction and arrangement of the cladding sheet being such that a plurality of sheets can be positioned in side by side juxtaposed relationship, the juxtaposed edge portions of adjacent sheets together defining a bearing beam running between the body portions of those sheets to provide rigidity to the cladding sheets when fixed to the building framework.

2. A cladding sheet as claimed in claim 1, wherein both edge portions extend generally perpendicularly outwardly of the plane of the body portion, and the edge portions are arranged so that juxtaposed edge portions of adjacent cladding sheets abut one another and thereby form a continuous cladding over the framework.

3. A cladding sheet as claimed in claim 2, wherein the edge portions extend downwardly from the body portion and include a terminal bearing zone remote from the body portion adapted to bear on the building framework when fixed thereto so that the body portion is spaced therefrom.

4. A cladding sheet as claimed in claim 2 or 3, wherein one of the edge portions has an abutment groove extending therealong and the other one of the edge portions has an abutment rib extending therealong, the abutment rib and the abutment groove being arranged so that the abutment rib of a cladding sheet engages in the abutment groove of an adjacent cladding sheet to facilitate fixing of those sheets to the framework.

5. A cladding sheet as claimed in any preceding claim, wherein the body portion is provided with a series of reinforcement ribs extending therealong, and the edge portions extend upwardly from the plane of the body portion such that when cladding sheets are positioned in side by side relationship, the juxtaposed edge portions of adjacent sheets together define a reinforcement rib.

6. A cladding sheet for a building framework substantially as hereinbefore described with reference to any one of the

embodiments illustrated in the accompanying drawings.

7. A cladding unit for a building framework, including: a cladding sheet as claimed in any preceding claim, that cladding sheet defining an exterior surface of the unit; and, cover means extending parallel to the body portion between the edge portions of the cladding sheet and defining an interior surface for the unit.

8. A cladding unit as claimed in claim 7, wherein the cover means is at least one cover panel removably connected to the edge portions and spaced from the body portion so as to define a cavity therebetween in which service componentry of the building may be positioned when the cladding unit is fixed to the building.

9. A cladding unit as claimed in claim 8 when appended to claim 3, wherein edge portions of the cover panel supportingly bear on the bearing zones of the cladding sheet edge portions for connection thereto so that the cover panel is suspended between the bearing zones of the cladding sheet.

10. A cladding unit as claimed in claim 8 or 9, and further including a plurality of elongated strengthening members extending within the cavity in spaced apart relationship across the cladding sheet to reinforce that cladding sheet against longitudinal distortion.

11. A cladding unit as claimed in any one of claims 8 to 10, and further including heat insulating material provided in the cavity.

12. A cladding unit as claimed in any one of claims 7 to 11, and further including an elongated sealing strip adapted to extend along and overlie juxtaposed edge portions of adjacent cladding sheets thereby to weather seal therebetween.

13. A cladding unit for a building framework substantially as hereinbefore described with reference to any one of the embodiments illustrated in the accompanying drawings.

14. In combination with the cladding sheet as claimed in any one of claims 1 to 6 or with the cladding unit as claimed in any one of claims 7 to 13, a cladding fixing strap including: a base portion adapted to be secured to the building framework; and, a clipping portion adapted to engage one or both juxtaposed edge portions of adjacent cladding

[redacted] thereby to fix those adjacent sheets to the building [redacted]

15. [redacted] combination as claimed in claim 14, wherein the clipping portion includes at least one finger adapted to engagingly overlie a part of one or both edge portions of the adjacent cladding sheets so as to capture the edge portion part(s) between the finger and building framework.

16. The combination as claimed in claim 15, wherein two fingers are provided each adapted to engage a respective one of the juxtaposed edge portions of the adjacent cladding sheets.

17. The combination as claimed in any one of claims 14 to 16, when appended to claim 3, wherein the clipping portion is adapted to engagingly overlie the bearing portion of one or both juxtaposed edge portions of the adjacent cladding sheets.

18. The combination as claimed in any one of claims 14 to 16, wherein the clipping portion is adapted to extend between the juxtaposed edge portions of the adjacent cladding sheets and engagingly overlie one or both of those juxtaposed edge portions.

19. The combination of a cladding sheet or cladding unit and a cladding fixing strap substantially as hereinbefore described with reference to any one of the embodiments illustrated in the accompanying drawings.

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JOHN de JONGH

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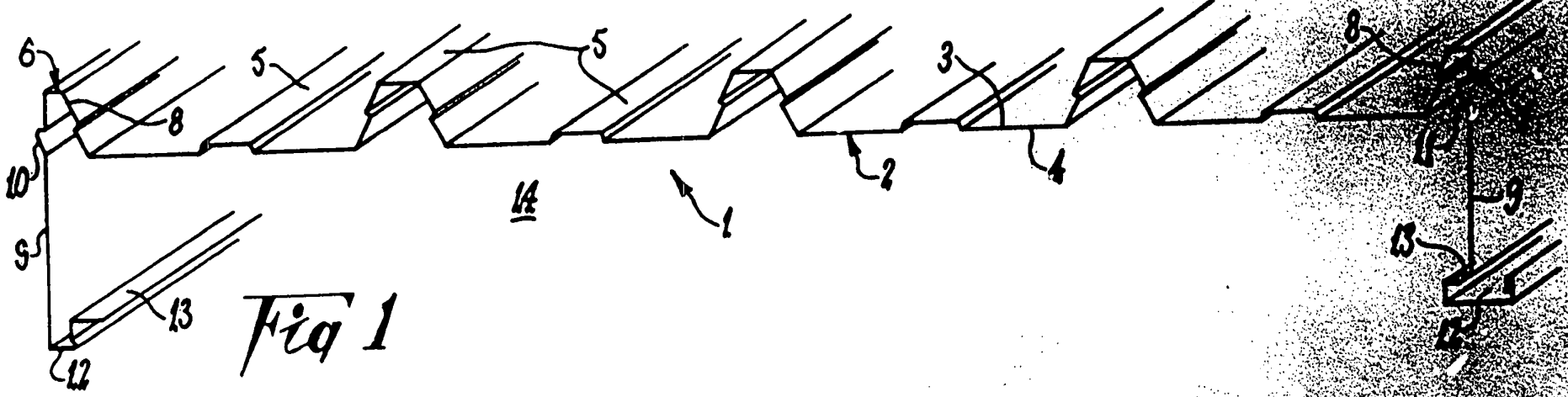

Fig 1

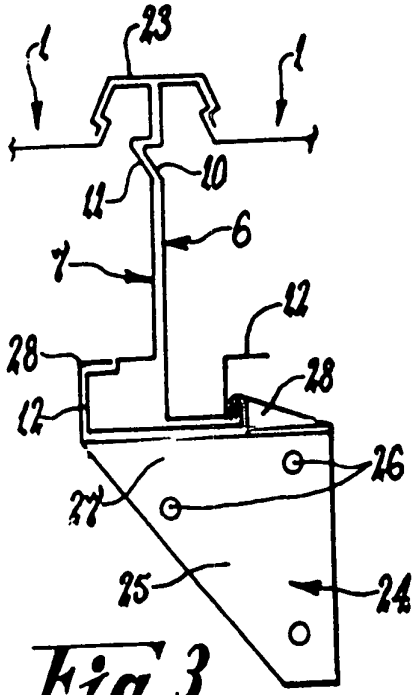

Fig 3

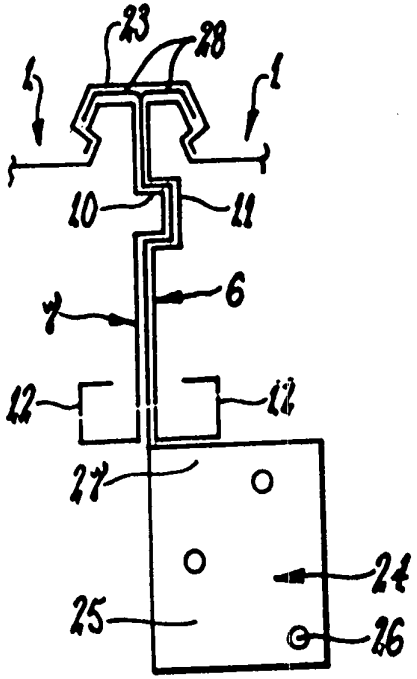

Fig 4

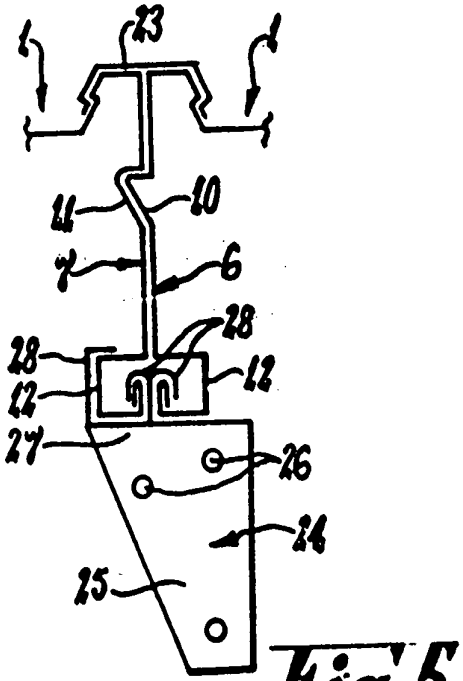

Fig 5

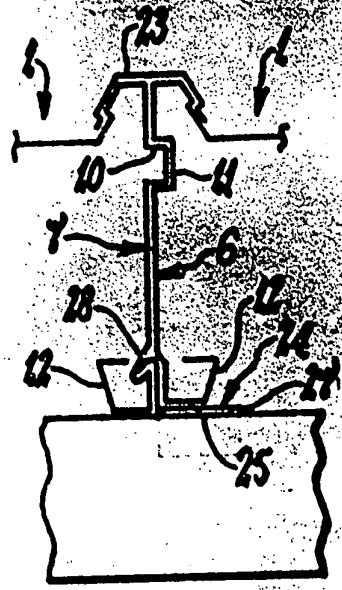

Fig 6

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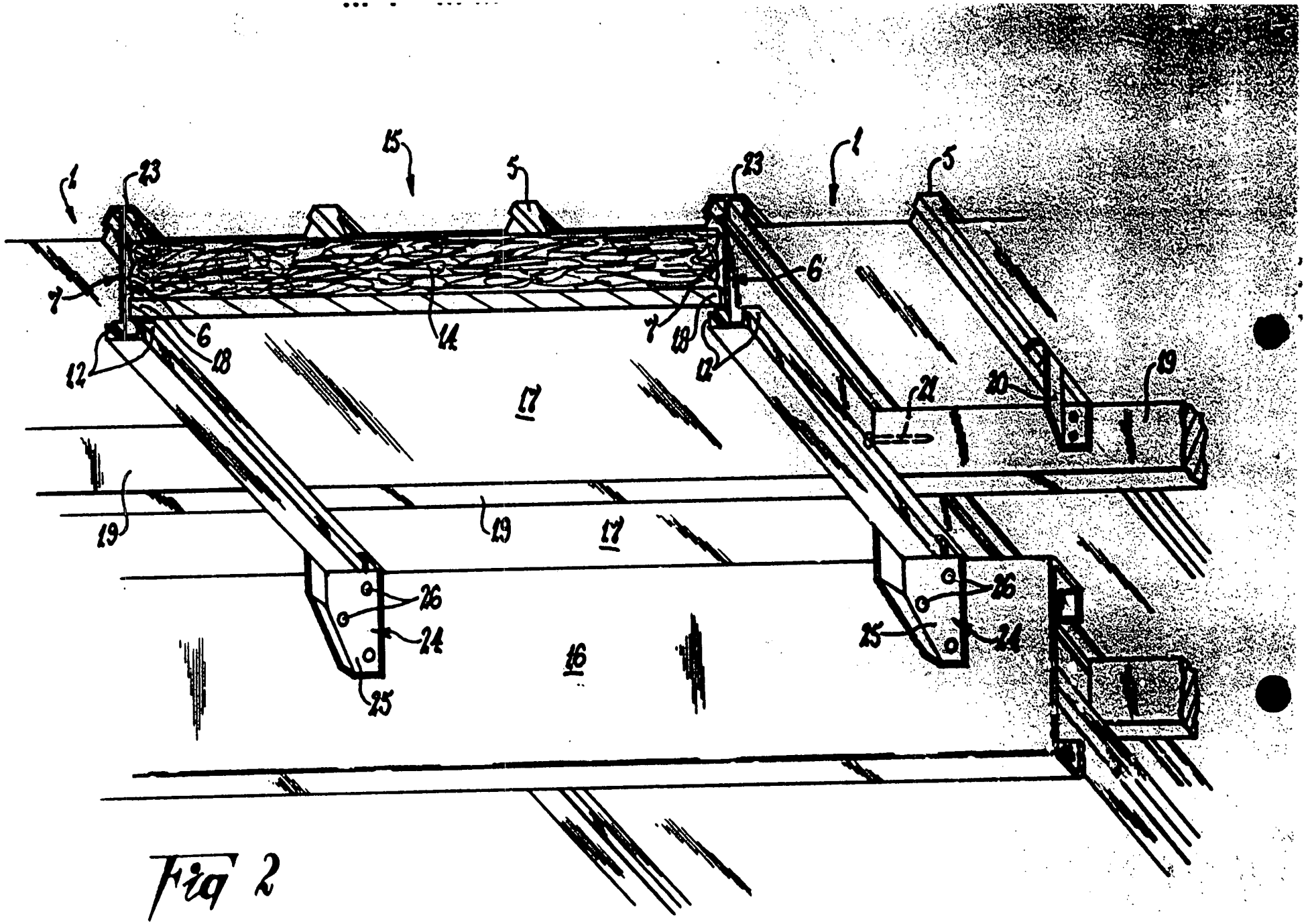
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Fig 2